

WHAT IS CLAIMED IS:

1. A variable gain amplifier comprising:

a variable gain amplifier circuit supplied with
an input signal and a feedback signal to amplify a
5 difference between the input signal and the feedback
signal to output an output signal;

a feedback circuit which supplies the feedback
signal to the variable gain amplifier circuit; and

a controller which controls the variable gain
10 amplifier circuit and the feedback circuit to decrease
a cutoff frequency of the feedback circuit with an
increase in a gain of the variable gain amplifier
circuit or vice versa.

2. A variable gain amplifier device according to
15 claim 1, wherein the feedback circuit outputs, as the
feedback signal, only a predetermined low frequency
component in frequency components of the output signal
of the variable gain amplifier circuit.

3. A variable gain amplifier device according to
20 claim 1, wherein the controller supplies a first
control signal to the variable gain amplifier circuit
to increase the gain of the variable gain amplifier
circuit and a second control signal to the feedback
circuit to decrease the cutoff frequency of the
25 feedback circuit simultaneously or a first control
signal to the variable gain amplifier circuit to
decrease the gain of the variable gain amplifier

circuit and a second control signal to the feedback circuit to increase the cutoff frequency of the feedback circuit simultaneously.

4. A variable gain amplifier device according to claim 1, wherein the feedback circuit comprises an operational amplifier, a variable capacitor and a first resistor which are connected in parallel between an inverting input terminal and output terminal of the operational amplifier, and a second resistor connected between the inverting input terminal of the operational amplifier and an output terminal of the variable gain amplifier circuit, a capacitance of the variable capacitor increasing with an increase in the gain of the variable gain amplifier and decreasing with a decrease of the gain of the variable gain amplifier.

5. A variable gain amplifier device according to claim 1, wherein the feedback circuit comprises an operational amplifier, a capacitor and a first resistor whose resistance is variable and which are connected in parallel between an inverting input terminal of the operational amplifier and an output terminal thereof, and a second resistor connected between the inverting input terminal of the operational amplifier and an output terminal of the variable gain amplifier circuit, the resistance of the first resistor increasing with an increase in the gain of the variable gain amplifier and decreasing with a decrease in the gain thereof.

6. A variable gain amplifier device according to claim 5, wherein the second resistor comprises a resistor whose resistance is variable, the resistance of the first resistor and the resistance of the second resistor increasing with an increase in the gain of the variable gain amplifier and decreasing with a decrease in the gain thereof as a constant resistance ratio is kept between the first resistor and the second resistor.

10 7. A variable gain amplifier device according to claim 1, wherein the feedback circuit comprises a first voltage-current converter, a capacitor connected to an output terminal of the first voltage-current converter, and a second voltage-current converter whose mutual
15 conductance is variable and which includes an input terminal connected to the capacitor and an output terminal, the input terminal and the output terminal being short-circuited, and the mutual conductance of the second voltage-current converter decreasing with
20 an increase in the gain of the variable gain amplifier circuit or vice versa.

8. A variable gain amplifier device according to claim 7, wherein a mutual conductance of the first voltage-current converter is variable, the mutual
25 conductance of the first voltage-current converter and the mutual conductance of the second voltage-current converter decrease at the same rate with an increase in

the gain of the variable gain amplifier circuit or vice versa.

9. A radio receiver comprising:

5 a baseband circuit which converts a radio signal into a baseband signal; and

a variable gain amplifier device according to claim 1 which amplifies the baseband signal.

10. A variable gain amplifier device comprising:

10 a variable gain amplifier circuit which amplifies a difference between an input signal and a feedback signal to output an output signal;

a feedback circuit which supplies the feedback signal to the variable gain amplifier circuit; and

15 a controller which controls the gain of the variable gain amplifier circuit and a cutoff frequency of the feedback circuit to make a lower limit frequency of the output signal substantially constant regardless of variation of a gain of the variable gain amplifier circuit.

20 11. A variable gain amplifier device according to claim 10, wherein the feedback circuit generates, as the feedback signal, only a predetermined low frequency component in frequency components of the output signal of the variable gain amplifier circuit.

25 12. A radio receiver comprising:

a baseband circuit which converts a radio signal into a baseband signal; and

a variable gain amplifier device according to claim 10 which amplifies the baseband signal.

13. A variable gain amplifier device comprising:

5 a variable gain amplifier circuit supplied with an input signal and a feedback signal to amplify a difference between the input signal and the feedback signal and output an output signal, a gain of the variable gain amplifier circuit being varied according to a level of at least one of the output signal and
10 the input signal; and

a feedback circuit which supplies the feedback signal to the variable gain amplifier circuit, a cutoff frequency of the feedback circuit being varied according to variation of the gain of the variable gain
15 amplifier circuit to make a lower limit frequency of the output signal substantially constant.

14. A variable gain amplifier device according to claim 13, wherein the feedback circuit generates, as the feedback signal, only a predetermined low frequency
20 component in frequency components of the output signal of the variable gain amplifier circuit.

15. A radio receiver comprising:

a baseband circuit which converts a radio signal into a baseband signal; and

25 a variable gain amplifier device according to claim 13 which amplifies the baseband signal.